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(71) Applicant: **SEGA ENTERPRISES, LTD.**  
**2-12 Haneda 1-chome**  
**Ohta-ku**  
**Tokyo 144 (JP)**

(72) Inventor: **SMITH, Jay, III**  
**348 Bentel Avenue**  
**Los Angeles, CA 90049 (US)**  
Inventor: **CURRAN, Kenneth, J.**  
**2829 Rikkard Drive**  
**Thousand Oaks, CA 91362 (US)**

(74) Representative: **Eisenführ, Speiser & Partner**  
**Martinistrasse 24**  
**D-28195 Bremen (DE)**

(54) **DUAL MODE PORTABLE GAME CONTROL DEVICE.**

(57) A portable control device for an electronic game system is such that one or more players can simultaneously control two game objects. A lever-shaped direction switch provided in a housing and adapted for manipulation by a thumb is used for selecting or controlling the movement of a primary object. A light detection/direction indicating system also provided in the housing is used for selecting or controlling the movement of a secondary object.

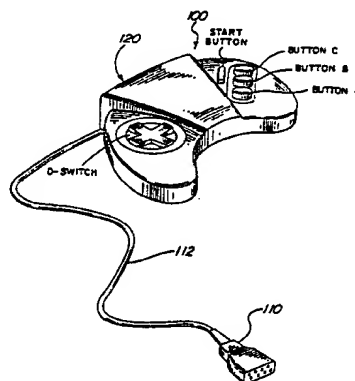


FIG. 3a

## TECHNICAL FIELD

The present invention relates to electronic gaming systems, more specifically, to hand-held controllers or control pads used with a microprocessor controlled gaming system and an associated raster scanned display or television.

## BACKGROUND ART

Computer gaming systems first arrived and gained wide spread popularity around the early 1980's. The initial games available for home use were relatively simple. For example, one of the early games consisted of two electronic paddles on either side of a screen and an electronic ball which two players bounced back and forth to one another in a tennis-like fashion. The input devices used with these early games were correspondingly simple, i. e. joysticks or rotary dials.

The Genesis (trademark) system, manufactured by Sega Enterprises Ltd. , is one of the most commercially successful gaming systems of modern times. As suggested by Figure 1, the Genesis system is based around a microprocessor controlled Gaming Device 10 which is connected to a raster scanned display (i.e. a standard television) . The gaming device 10 accepts a game cartridge and has electronic plug inputs 12, 13 for communication with two hand-held control pads. A conventional control pad 30 is depicted in Figure 2. The game cartridge contains the appropriate firmware which, in connection with the gaming device 10, processes player commands from the control pads 30 and to display the changing action of a particular game on the television. A detailed explanation of the gaming device 10 is not necessary for an understanding of the present invention which is directed to an enhanced control pad.

Figure 2 illustrates the exterior of a conventional control pad 30 currently available with the Genesis system. As shown, the conventional control pad 30 is comprised of a joystick-like directional button (D-Switch) on its left side and a plurality of control buttons (A,B,C, and Start) on its right side. The user generally operates the control pad 30 by holding it in both hands so that the left thumb is positioned over the D-Switch and so that the right thumb is positioned over the A,B,C, and Start buttons.

We'll use a hypothetical basketball game to explain the use of the conventional control pad 30. Passing the ball from player to player is a desirable feature in such a game. Given a conventional control pad 30, the user might use the D-Switch to direct the movement of the player with the ball and simultaneously press the A Button to consecutively select one of the other four players to receive the pass. The user might then pass the ball to the selected player by pressing the C Button. While this may be a complicated process for some people, many children and certain game playing adults are capable of relatively high levels of hand/eye coordination. The conventional control pad 30 was a significant step in addressing the needs of such gifted players. However, returning to our specific basketball example, note that the player cannot use the conventional control pad 30 to immediately select a particular player to receive the pass. As shown by this one example, there is still room for improvement in gaming systems and, more specifically, for enhanced control capability and greater complexity.

The present invention resolve the above-noted shortcomings with existing control pads and addresses the never ending consumer demand for games of progressively greater complexity.

## DISCLOSURE OF INVENTION

In order to achieve the above object, according to the invention defined in claim 1, an input device for use with a raster scanned display on which a primary object and a secondary object are displayed comprises a housing being sufficiently small so that it may be hand held and so that it may be selectively pointed at a particular position on the display; a primary input means for controlling a travel direction of the primary object, the primary input means comprised of an operable member on said housing; and a secondary input means- for simultaneously controlling the secondary object based on the particular position.

According to the invention defined in claim 2, the secondary input means controls a travel direction of the secondary object.

According to the invention defined in claim 3, the secondary input means controls a selection of one of a plurality of possible secondary objects.

According to the invention defined in claim 4, a hand-held controller for use with a microprocessor controlled gaming device and an associated raster scanned display comprises (a) and (b).

(a) A first control means for controlling a first object displayed on the raster scanned display includes an operable member on the hand-held controller, the operable member being physically movable to specify

a first desired direction; and a means for providing the gaming device with a first control signal which corresponds to the first desired direction.

(b) A second control means for controlling a second object displayed on the raster scanned display includes a means for indicating a second desired direction by pointing the hand-held controller at a  
5 desired position on the raster scanned display; and a means for providing the gaming device with a second control signal which corresponds to the second desired direction.

According to the invention defined in claim 5, the operable member of the first control means is comprised of a plurality of electromechanical switches.

According to the invention defined in claim 6, the indicating means is comprised of an optical focusing  
10 means for focusing a portion of the raster scanned display onto a pickup device; and a means for determining which portion of the raster scanned display is focused onto the pickup device.

According to the invention defined in claim 7, the means for determining which portion of the raster scanned display is focused onto the pickup device comprises the optical sensor circuit with the optical  
15 biasing LED.

## BRIEF DESCRIPTION OF DRAWINGS

Figure 1 is a perspective illustration of a conventional gaming device 10 which is a basic unit in a gaming system known as the Genesis system;

20 Figure 2 is a top plan view of a conventional control pad 30 used with the conventional gaming device of Fig. 1;

Figure 3a is a perspective view of a preferred dual-mode hand-held controller 100 according to the present invention;

25 Figures 3b, 3c, and 3d are respectively a top plan view, a front elevational view and a side elevational view of the preferred dual-mode hand-held controller 100 of Fig. 3a;

Figure 4 is a perspective view of the preferred dual-mode hand-held controller 100 as used with a hypothetical basketball game wherein the user is moving a first player 60 (the one dribbling the ball) with the left thumb while simultaneously selecting another player 62 (the one to receive a pass from the first player) by pointing at that player;

30 Figure 5 is a schematic diagram of the circuitry used in the preferred dual-mode hand-held controller 100 of Fig. 4, which circuitry is based around an Application Specific Integrated Circuit ("ASIC") 200;

Figure 6 is a schematic diagram of the communication and control logic implemented within the ASIC 200 of Fig. 5;

Figure 7 is a functional block diagram corresponding to an optical sensor circuit 300 shown in Fig. 6;

35 Figures 8a and 8b are respectively a top plan view and a side view of the relationship between the printed circuit board, the fresnel lenses, and the sensor (phototransistor 322) used with the dual-mode controller 100 of the present invention; and

40 Figures 9a and 9b are top plan views of a two-piece housing structure for the preferred hand-held controller 100, with a front fresnel lens mounted in one half of the housing and a rear fresnel lens mounted on the PC board.

## BEST MODE FOR CARRYING OUT THE INVENTION

The following description is provided to enable any person skilled in the field of electronic games to  
45 make and use the invention and sets forth the best modes contemplated by the inventors of carrying out their invention. Various modifications, however, will remain readily apparent to those skilled in these arts, since the generic principles of the present invention have been defined herein specifically to provide an enhanced dual-mode hand-held controller for electronic games.

Figures 3a-3d depict a preferred dual-mode hand-held controller 100 according to the present invention.  
50 As shown, the dual-mode controller 100 retains the control buttons associated with a convention controller 30 shown in Figure 2: i.e. a D-Switch (joystick) and the A, B, C, and Start Buttons. However, in addition to these conventional buttons, the dual-mode controller 100 of the present invention incorporates an optical detection system 370 which allows the controller to be simultaneously used like a joystick and like an optical pointer. The dual-mode controller 100 allows each user to simultaneously control two independently  
55 movable objects.

The optical detection system of the dual-mode controller 100 includes a lens system 370 (see Figure 7) comprised of one or more lenses which, in the preferred embodiment, is comprised of a pair of fresnel lenses 120, 122. The outermost lens 120 is visible in Figure 3c and the relationship between the two lenses

and an external PCB and a phototransistor 322 is shown in Figures 8a and 8b. Two fresnel lenses were used as shown in order to obtain a shorter focal length.

As shown in Figure 4, the dual-mode hand-held controller 100 is, like the conventional controller 30, intended to be held in the player's two hands. However, the dual-mode controller 100 offers a significant advantage over the conventional controller 30 in that the dual-mode controller 100 allows each of one or more players to control two game objects at the same time.

We will return to the hypothetical basketball game and the ball passing example that we discussed above to illustrate the advantages of this new controller. Referring to Figure 4, we see that the player's left thumb 62 is operating the D-Switch to control the movement of the basketball player 60 that is dribbling the ball 64. At the same time, the player can move the entire controller 100 in any desired direction, as suggested by solid lines 68, 69 and aim the controller at a particular player, as suggested by dashed line 67 and as optionally shown by a display cursor 65, in order to select and then pass the ball 64 to that other basketball player, in this case player 62. Preferably, a symbol such as symbol 65 appears on the screen 70 to provide the player with a visual feedback as to where the controller 100 is pointing.

The just described passing procedure for a basketball game is just an example. The dual-mode hand-held controller 100 could be used with numerous other games. In addition, two controllers can be used at the same time by two different players such that each can control two objects at the same time. This is a particularly important advantage with respect to two players games that simulate competitive sports. The following list of possible games and associated functions is just the tip of the iceberg:

#### Football

- Point at receiver to determine where to throw pass
- Point to active player to control receiver route
- Point in front of a runner as a directional guide
- Control blockers by pointing, runner with D-Switch

#### Basketball

- Point at the player to pass to
- Move another player in position to set a pick
- Human accuracy (quickly place cursor on basket before shot)

#### Baseball

- Select the base to throw to
- Control base runner
- Bat by pointing at pitch location

#### Tennis

- Move both players on your side in a doubles match

#### Hockey

- Control passing by identifying the player to pass to
- Control player away from puck for blocking

#### Shooting

- Control where the shot is aimed
- Select targets independently of hero or vehicle direction
- Hit menu choices at any time

Figures 5 and 6 illustrate a preferred circuitry for implementing a dual-mode hand-held controller 100 according to the present invention. Figure 5 is a view of the "forest", including an ASIC (IC for specific use) 200 shown in block diagram form and Figure 6 is a view of the "trees" within the ASIC 200.

As shown by Figures 1 and 3a, the hand controller 100 is connected to an electronic plug input 12 or 13 on the gaming device 10 via a cable 112 and a 9-pin connector 110. From left to right, Figure 5

generally depicts the 9-pin connector 110, the cable 112, the ASIC 200, an R/C network 215 comprised of a resistor 212 and a capacitor 214, a plurality of momentary contact switches (up, down, left, and right) which collectively comprise the D-Switch, the A, B, C, and Start buttons, and an optical sensor circuit 300. It is expected that future embodiments of the invention will incorporate even more control buttons.

5 The optical sensor circuit 300 of Figure 5, as suggested by the corresponding block diagram of Figure 7, monitors image data 73 contained within a target area 74 of the television screen 70. The image data 73 is focused through a lens system 370 onto a phototransistor 322 which is sensitive to visible light. Thus, every time a horizontal scan line 76 passes through the target area 74, the phototransistor 322 generates a pulse which is amplified by an amplifier 325 and output as an amplified pulse signal 325a. A resistive  
10 divider circuit 326 generates a reference voltage which is provided as a reference signal 326a. A comparator 327 compares the amplified pulse signal 325a with the reference signal 326a and, whenever the former exceeds the latter, outputs a horizontal scan detection signal 327a to pin 17 of the ASIC 200.

The optical sensor circuit 300 features an optical biasing LED 321 which, in the preferred embodiment, is physically located immediately adjacent to the phototransistor 322. The gain of the phototransistor 322 is  
15 zero when there is no base drive. The gain generally increases as the base drive increases. The use of the optical biasing LED allows for the two-legged phototransistor 322 instead of a standard three-legged phototransistor having an electrical base drive input. The latter device is undesirable because an attempt to increase gain may actually reduce gain. In particular, the resistive network used to electrically biasing the device may act as a low impedance shunt for any photocurrent generated by the device. It has been  
20 discovered that a sensitivity increase of 20:1 can be obtained with the optical biasing LED 321.

A bias driver 323 provides the necessary current to drive the optical biasing LED 321 at a current which makes it sufficiently bright. At the present time, the preferred bias LED 321 is red in color and is driven at 10 mA. It is supposed that amber or orange LEDs may be preferred over red because of their generally higher quantum efficiencies.

25 The target area 74 encompasses about sixteen scan lines 76 when the preferred hand-held controller 100 is held an average distance from an average sized television. The object is to detect the central most scan line which provides the longest and highest intensity pulse. Returning to the Figure 6 logic diagram of the ASIC 200, we see that the horizontal scan detection signal 327a that is input at pin 17 drives the clock input CLK of a counter 210 which is configured as an up counter. For each horizontal scan line 76 that  
30 crosses the target area 74, the counter 210 counts up, with its outputs Q1, Q2, Q3, Q4 going successively from binary 0000 to binary 1111. Two inverters 211, 212 are driven by output Q4. When the count reaches decimal 8, i.e. when Q4 goes high to provide binary 1000, then the inverters 211, 212 go low. The output of inverter 212 is provided to the gaming device 10 over pin 5 as a scan line detection signal. As is well known in the art, the gaming device 10 can easily compute the screen location at which the detection occurred  
35 based on the time that it received the scan line detection signal relative to the beginning of the vertical retrace. The output of inverter 211 is provided to the clock input CLK, thereby freezing the counter 210 and stopping the count at 8 until the counter 210 receives a reset signal RST during the next vertical retrace.

During each vertical retrace of the television display 70, a conventional control pad 30 like that shown in Figure 2 identifies itself as a hand controller and communicates button press data to the gaming device 10  
40 over six ports P0-P5 (lines 1-4, 18, and 19). Because there are more than six pieces of data to be transmitted, a multiplexing scheme has been employed wherein the gaming device transmits a multiplex control signal to the conventional control pad 30 over port P6 (line 5). The picture becomes even more complicated given a dual-mode controller 100 according to the present invention because now the gaming device must determine which type of controller is attached and the controller 100 must transmit scan line  
45 data in addition to button press data.

The present inventors have developed a novel circuitry which allows their dual-mode controller 100 to act as either a standard controller 30 or as a dual-mode controller 100 and which overcomes the need for additional lines. Thus, the dual-mode controller 100 can operate in a "conventional" mode or in an "optical" mode. The ports P0, P1 (lines 18 and 19) are always outputs from the conventional controller 30 and the  
50 port P6 is always a multiplex control input to the conventional controller 30.

On the other hand, in the dual-mode controller circuit of Figure 6, the ports P0, P1, and P6 are bi-directional, serving as either data output ports (in conventional mode) or as command input ports (to place the controller in optical mode and thereafter provide control signals).

The ASIC 200 contains a multiplex logic block 240 as shown in Figure 6. If the dual-mode controller 100  
55 is in the conventional mode, then the multiplex logic block 240 causes the controller to function as a conventional controller. On the other hand, if the dual-mode controller 100 is in the optical mode, then the multiplex logic block 240 causes the controller to function as follows:

## Dual Mode

	<u>Controller Port</u>	<u>Direction</u>	<u>P1-Line 18</u>	<u>Function</u>
5	P0	Input		Counter Reset
	P1	Input		Data Select
10	P2	Output	H	Left
	P3	Output	H	Right
15	P4	Output	H	"B" Button
	P5	Output	H	"C" Button
	P6	Output		Scan Line Data
20				
	P0	Input		Counter Reset
25	P1	Input		Data Select
	P2	Output	L	UP
	P3	Output	L	DOWN
30	P4	Output	L	"A" Button
	P5	Output	L	"Start" Button
35	P6	Output		Scan Line Data

Table 1 - Dual-Mode Controller

40 A pair of pull-up resistors 220, 222 keep the ports P0, P1 nominally high. The ports P0, P1 of the dual-mode controller 100 are connected to the inputs of a NOR gate 223. The dual-mode controller 100 is placed in the optical mode by dropping and generally holding the ports P0, P1 low from the gaming device 10. We say "generally" low because the ports P0, P1 are periodically spiked high to reset the counter 210 during every vertical retrace (as described earlier) and to multiplex the button press data for eight buttons over 4 lines (see Table 1 above).

45 It is important to ensure that the relatively short high logic control signals applied to the ports P0, P1 from the gaming device not cause the dual-mode controller 100 to inadvertently switch from the optical mode into the conventional mode. The ability for short duration high logic control spikes to be accommodated is accomplished with an R/C network as follows. When the ports P0, P1 are pulled low by the gaming device 10, the output of the NOR gate 223 goes high and is inverted low at pin 15 by an inverter 224. As shown in Figure 5, pin 15 is connected to the top of an R/C network. The output of the R/C network, taken between the resistor 212 and the capacitor 214, is returned to the ASIC 200 and connected to a second input of the latch 230 at pin 16.

50 When the gaming device 10 pulls the ports P0, P1 low for a relatively long period of time to put the dual-mode controller 100 into the optical mode, then the capacitor 214 will fully charge and the output of the inverter 224 will be diverted to pin 15 of the ASIC 200, thereby setting the latch 230. On the other hand, the relatively short button press output signals that periodically occur on ports P0 and P1 will not fully charge the capacitor 214 of the R/C network 210. Thus, the latch 230 will not be inadvertently reset by such

short duration pulses.

The operational mode of the Figure 6 circuitry depends on whether or not the game cartridge is a "conventional" game or an "optical" game that can operate with a dual-mode controller 100 according to the present invention. The software of an optical game will initially cause the gaming device 10 to determine which type of controller is connected (conventional 30 vs. dual-mode 100) by dropping the ports P0, P1 low. The optical game software then determines whether or not the controller has gone into optical mode by checking the data at ports P2 P3, which, in the case of an conventional controller, would both be low. However, as reference to Table 1 above shows, a dual-mode controller 100 has UP/DOWN attached to the ports P2 , P3 when P1 is low. The UP and DOWN button cannot be pressed at the same time due to physical limitation associated with the D-Switch. Thus, given a dual-mode controller, P2 and P3 cannot both be low (as with a conventional controller 30) and the game software will conclude that a dual-mode controller 100 is attached. If both ports P2 , P3 are low, the game software will conclude that a conventional controller 30 is attached.

While the above features of the present invention teach an apparatus for a dual-mode hand-held controller, it can be readily appreciated that it would be possible to deviate from the above embodiment without departing from the spirit of the invention. As will be readily understood by those skilled in the art of electronic games, the invention is capable of many modifications and improvements within the scope and spirit thereof. Accordingly, it will be understood that the invention is not to be limited by the specific embodiments but only by the following claims.

#### INDUSTRIAL APPLICABILITY

As described above, the controller of the present invention is suitable for a hand-held controller for an electronic gaming system wherein each of one or more players can control two gaming objects at the same time.

#### Claims

1. An input device for use with a raster scanned display on which a primary object and a secondary object are displayed comprising :
  - a housing being sufficiently small so that it may be hand held and so that it may be selectively pointed at a particular position on the display;
  - a primary input means for controlling a travel direction of the primary object, said primary input means comprised of an operable member on said housing; and
  - a secondary input means for simultaneously controlling the secondary object based on the particular position.
2. The input device of claim 1, wherein the secondary input means controls a travel direction of the secondary object.
3. The input device of claim 1, wherein the secondary input means controls a selection of one of a plurality of possible secondary objects.
4. A hand-held controller for use with a microprocessor controlled gaming device and an associated raster scanned display comprising:
  - (a) a first control means for controlling a first object displayed on the raster scanned display including:
    - an operable member on the hand-held controller, the operable member being physically movable to specify a first desired direction; and
    - a means for providing the gaming device with a first control signal which corresponds to the first desired direction; and
  - (b) a second control means for controlling a second object displayed on the raster scanned display including:
    - a means for indicating a second desired direction by pointing the hand-held controller at a desired position on the raster scanned display; and
    - a means for providing the gaming device with a second control signal which corresponds to the second desired direction.

5. The hand-held controller of claim 4, wherein the operable member of the first control means is comprised of a plurality of electromechanical switches.
6. The hand-held controller of claim 4, wherein the indicating means is comprised of ;  
5 an optical focusing means for focusing a portion of the raster scanned display onto a pickup device; and  
a means for determining which portion of the raster scanned display is focused onto the pickup device.
7. The hand-held controller of claim 6, wherein the means for determining which portion of the raster scanned display is focused onto the pickup device comprises the optical sensor circuit with the optical  
10 biasing LED.

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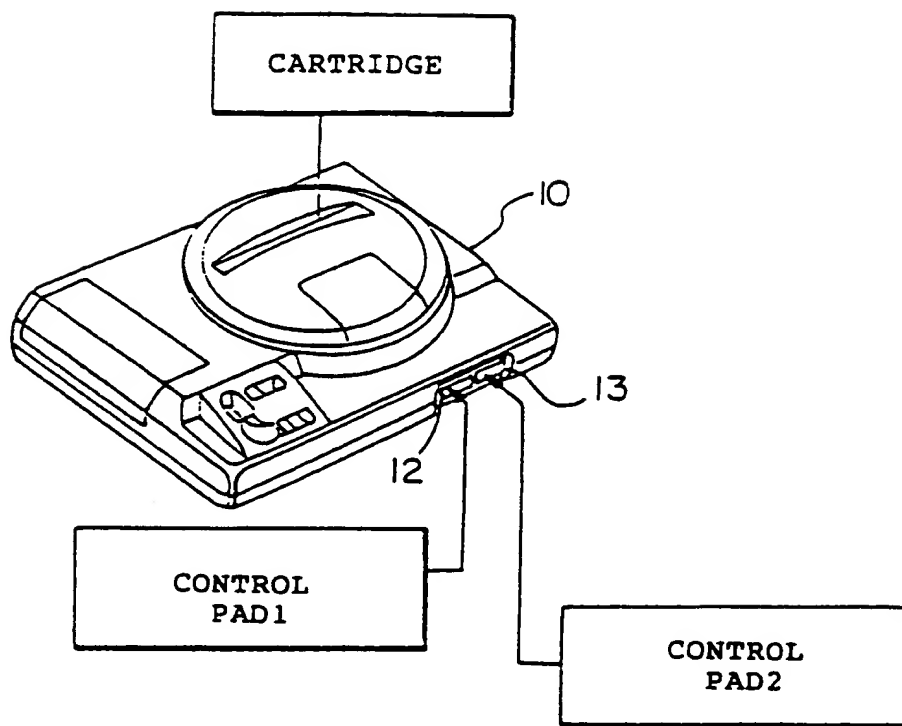


FIG. 1

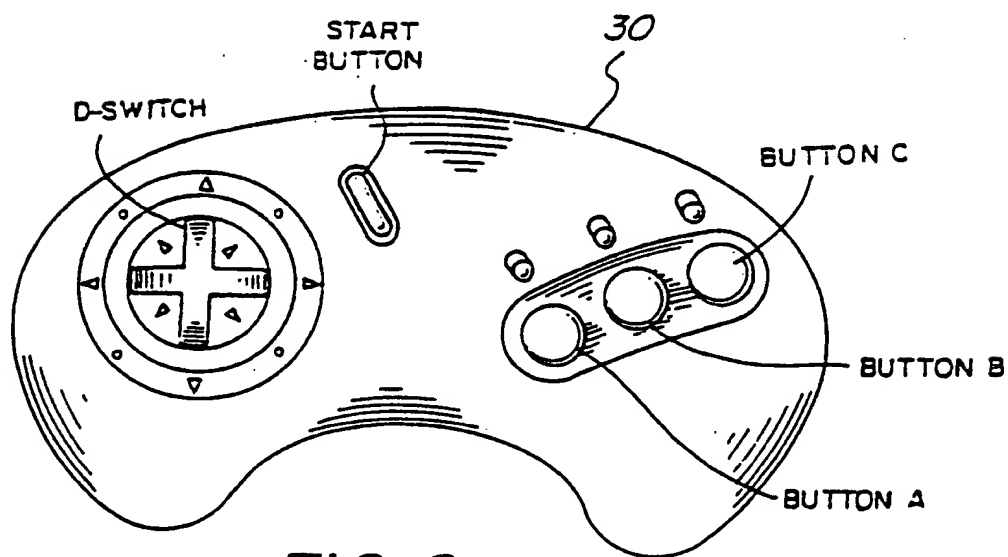


FIG. 2

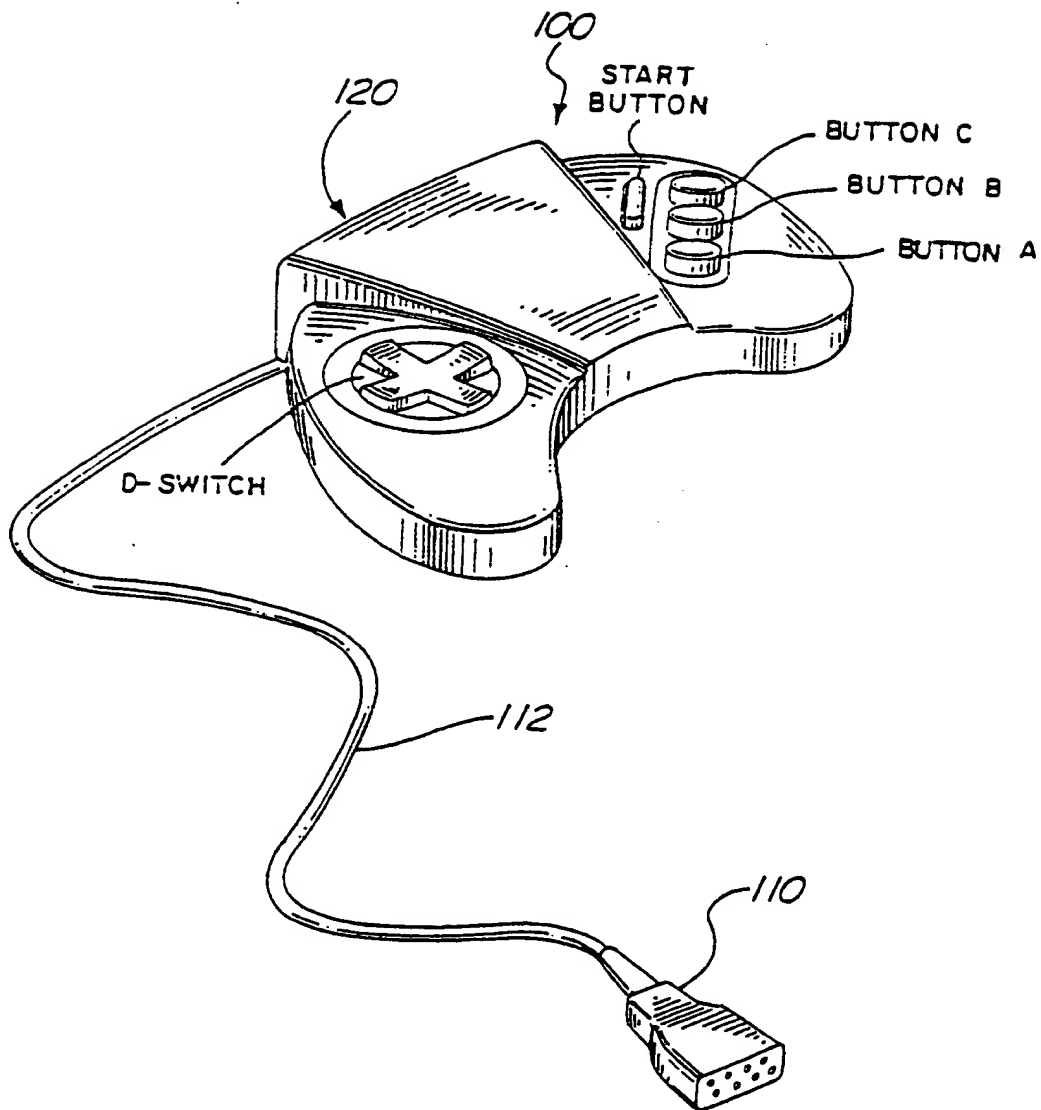
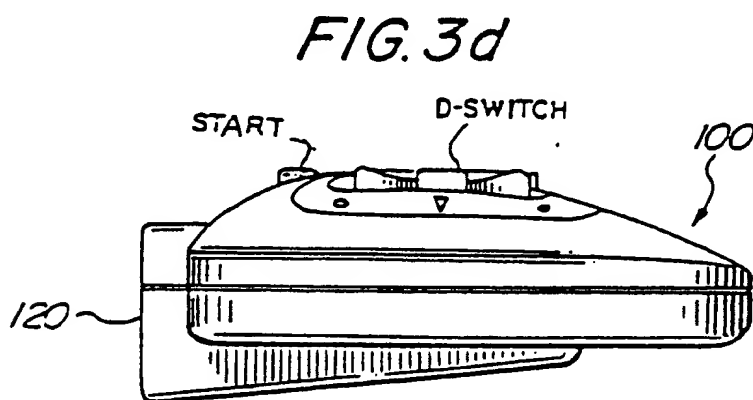
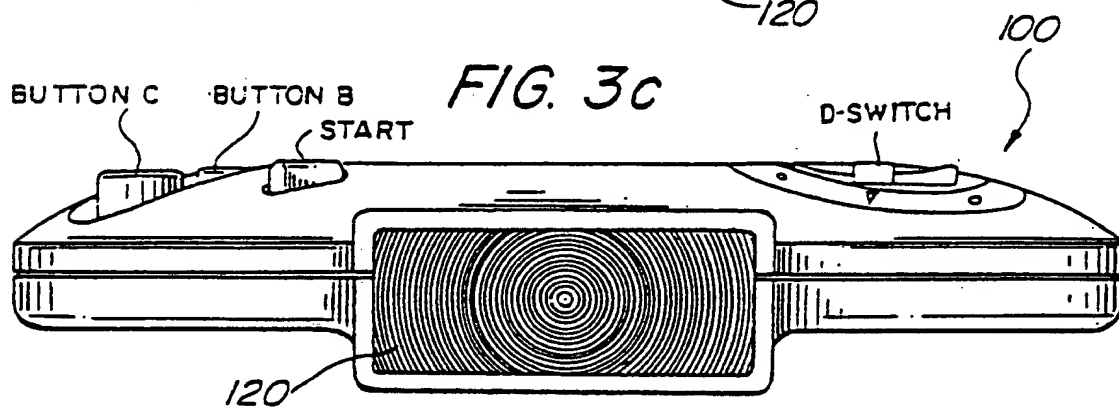
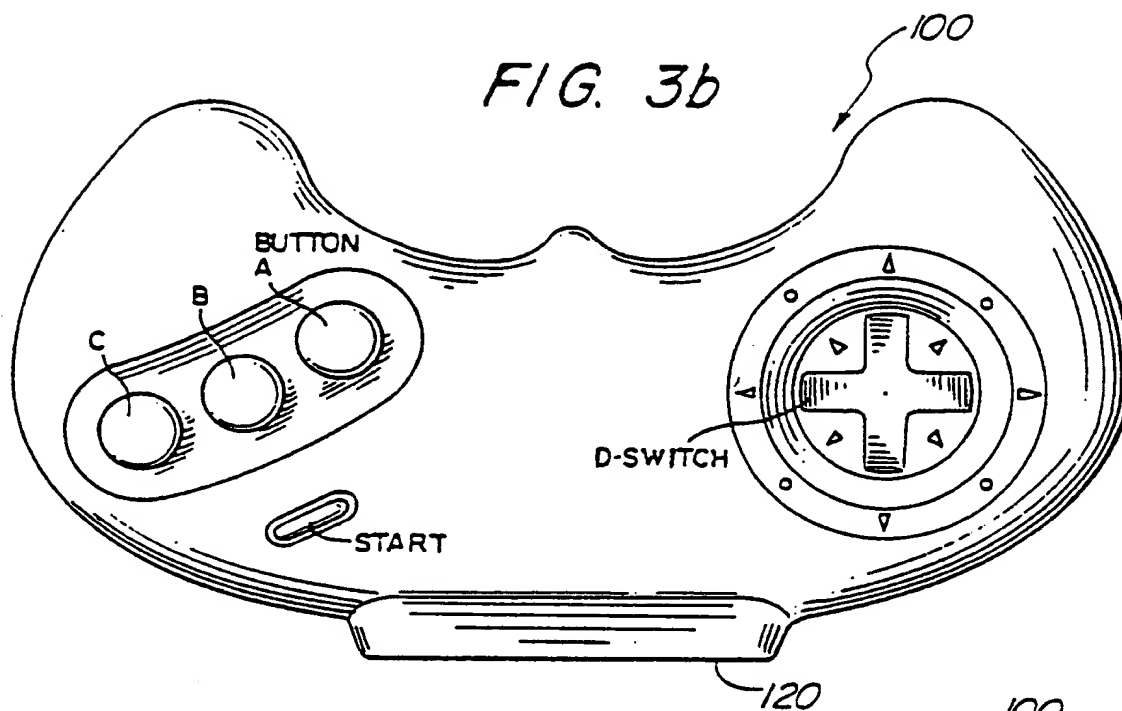


FIG. 3a



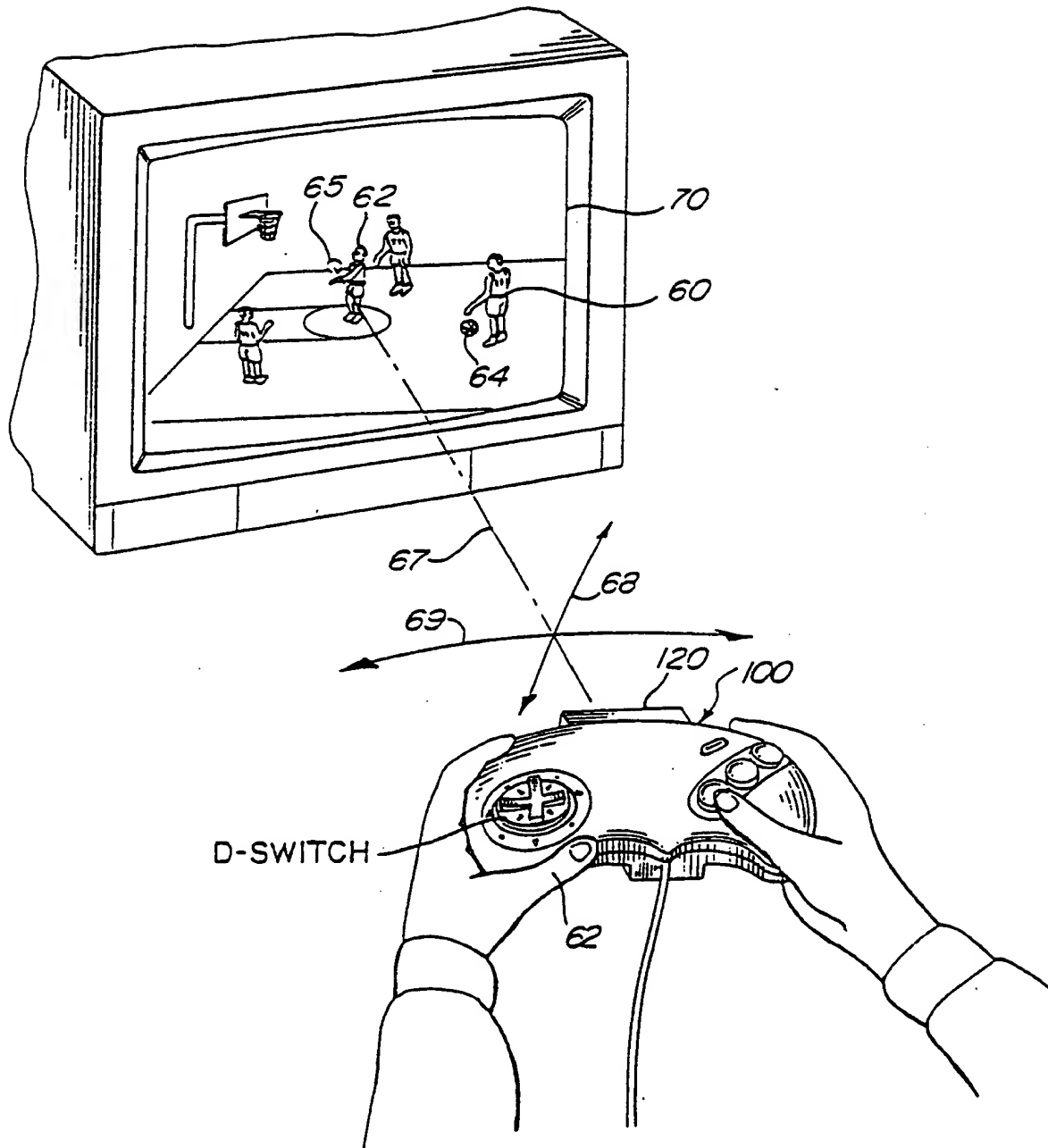


FIG. 4

FIG. 5

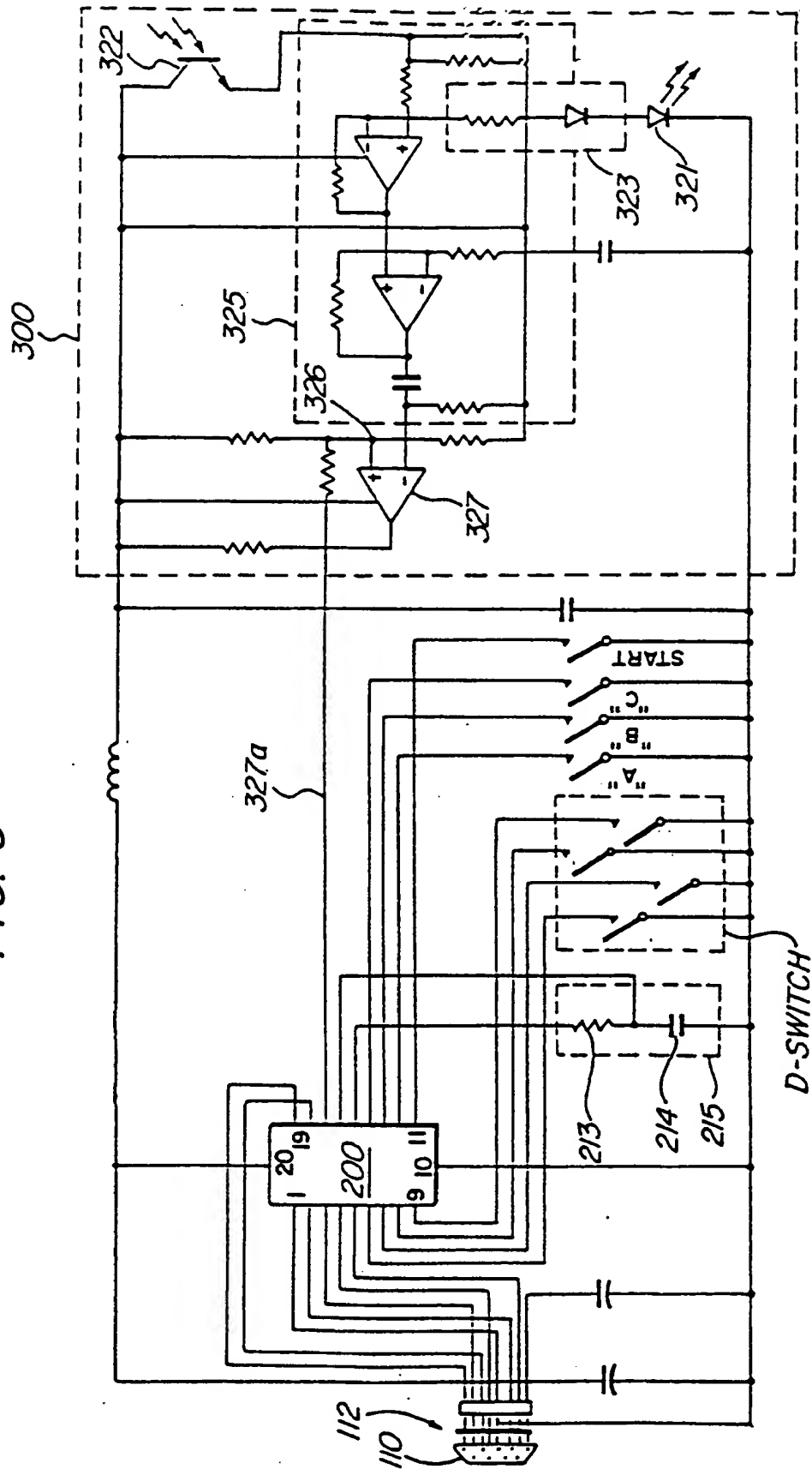
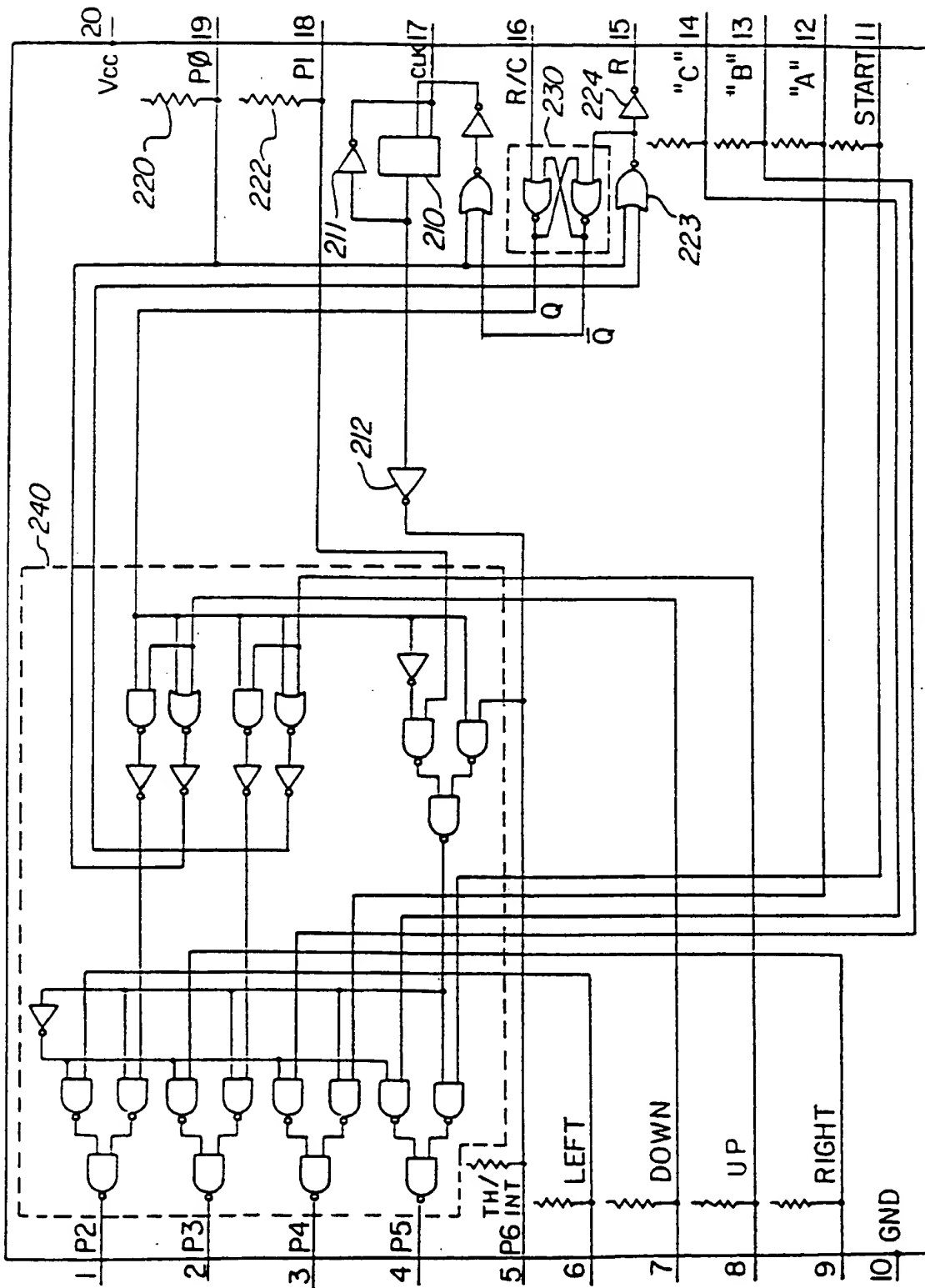


FIG. 6



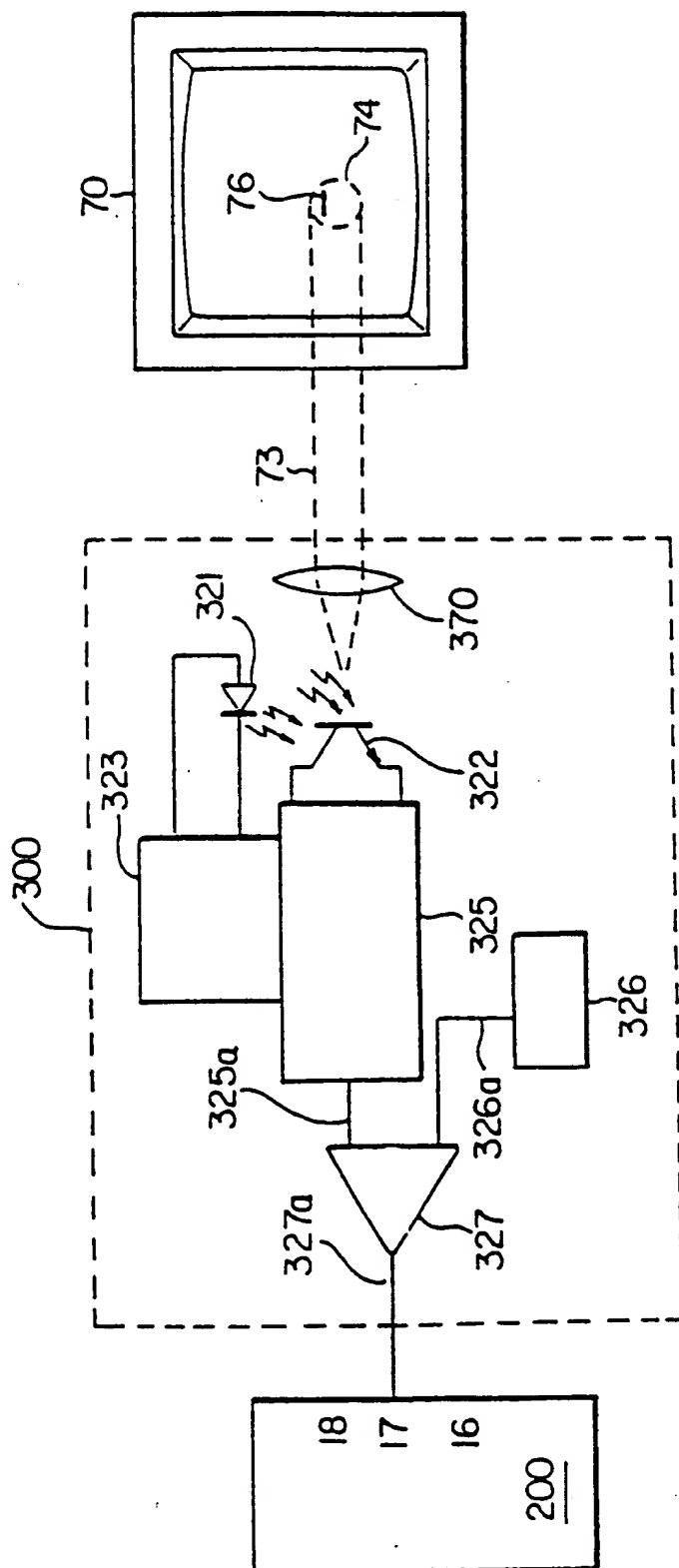


FIG. 7

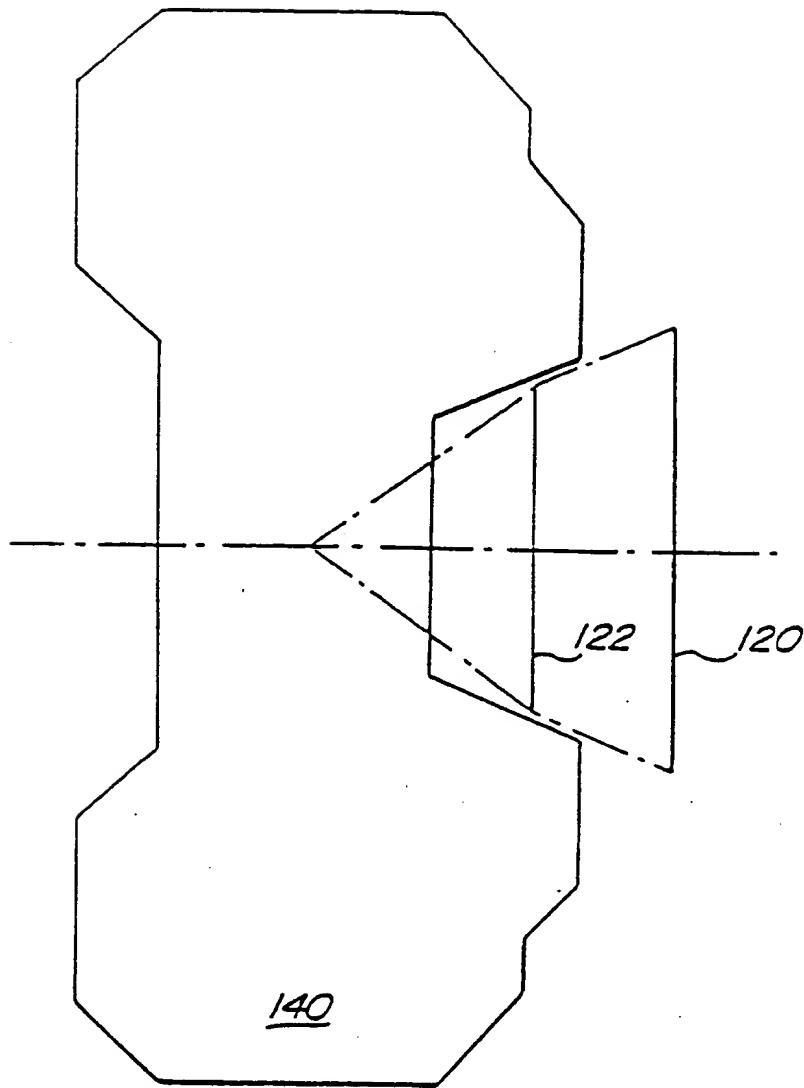


FIG. 8a

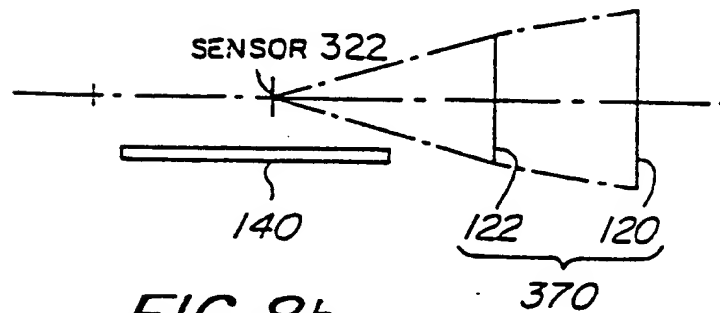


FIG. 8b



FIG. 9a

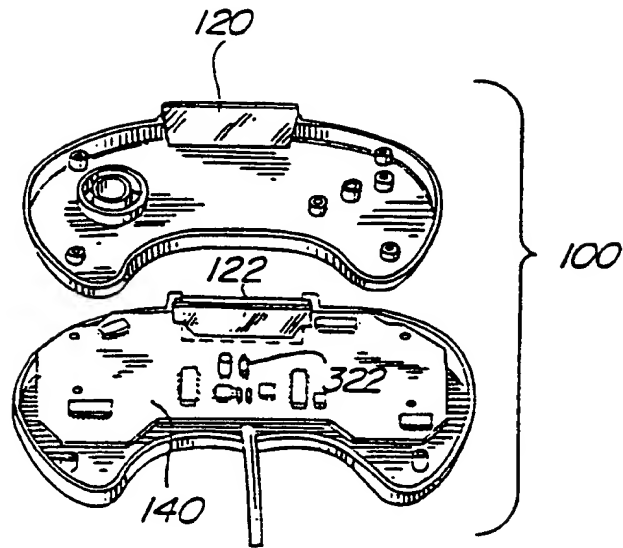
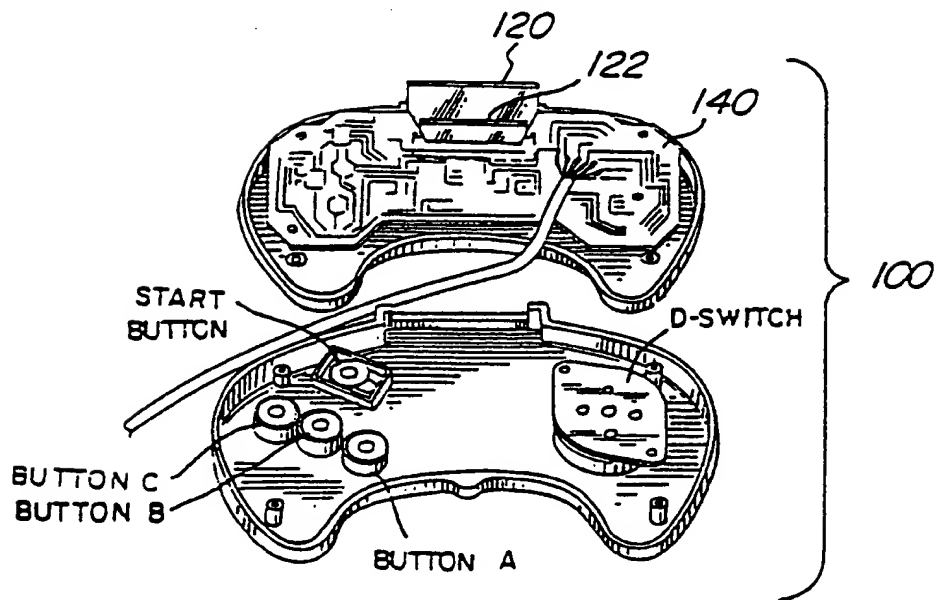


FIG. 9b



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP94/00009

## A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl<sup>5</sup> G06F3/033, A63F9/22

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Int. Cl<sup>5</sup> G06F3/033, A63F9/22

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho 1971 - 1992

Kokai Jitsuyo Shinan Koho 1971 - 1992

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP, U, 2-41342 (Nintendo Co., Ltd.), March 22, 1990 (22. 03. 90)	1-5
X	JP, A, 2-283390 (Hadoson K.K.), November 20, 1990 (20. 11. 90), (Family: none)	1-5
Y	JP, A, 2-134182 (Namco Ltd.), May 23, 1990 (23. 05. 90), (Family: none)	6, 7

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

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Date of the actual completion of the international search

March 30, 1994 (30. 03. 94)

Date of mailing of the international search report

April 19, 1994 (19. 04. 94)

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